1898

Four-Year Research Project Shows

Temperatures, Methods Used in Freezing Determine Tenderness, Color of Meat

- **Steaks frozen at 0°F. and below were more tender than unfrozen**
- **Freezing at 15°F. and 10°F. had an adverse effect on tenderness**
- **Steaks frozen at —30-40°F. had most desirable color**
- **Steaks frozen at 15°F. were quite dark in color**
- **Juiciness was the only characteristic affected unfavorably**

Freezing might be classified as one of the older methods of food preservation. Yet, results from a four-year freezing study recently conducted at the Oklahoma Agricultural Experiment Station* show that freezing is perhaps the "best" method of preserving the natural quality characteristics of meat.

Enhanced by Freezing

Moreover, if proper freezing techniques are employed, the major quality characteristics of beef may actually be enhanced by freezing. Consequently, the old adage that frozen meats are inferior in quality is simply not true.

Today, women comprise almost 35% of the labor force in the United States.

This means that there are over 13,485,000 "working homemakers" who want and need "convenience" built into food items. The vast number of frozen "quick-fix foods" available in all stores indicates that the food industry is cognizant of the modern housewife's problems.

Thus, it is only natural that considerably more attention be devoted to the marketing of convenient, waste-free, prepackaged, frozen retail meat cuts. Frozen meat offers much flexibility and can be tailored to meet the diverse desires of the working housewife.

When one considers the economics offered by centralized processing and the greater stability of the product throughout distribution channels, one might expect frozen meat to exert considerable influence on future marketing practices.

In addition to price, consumers often list "inconsistent product quality" as a major reason for avoiding frozen meat at the retail level. There is no reason for these two detriments to exist.

The problem of competitive pricing must be reconciled between processor and retailer; neither can afford an exorbitant mark-up.

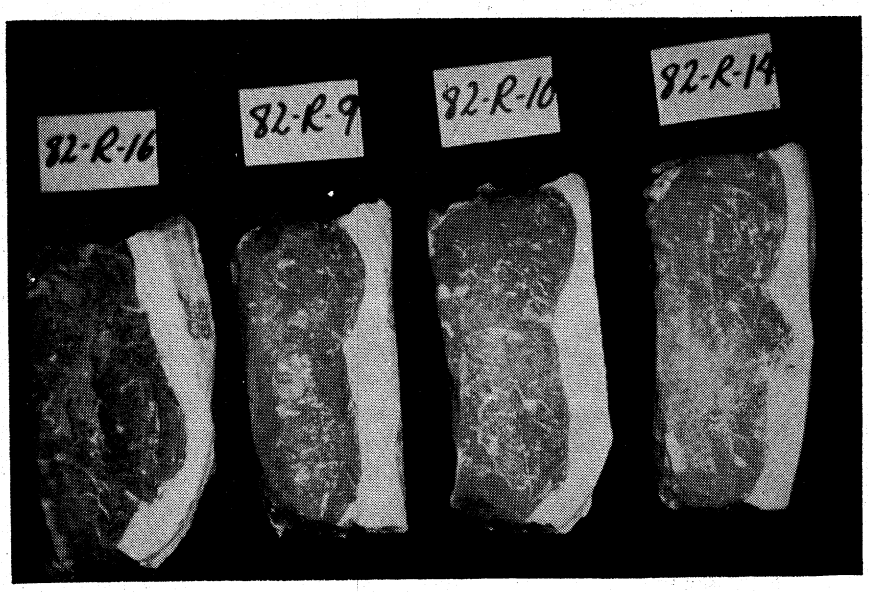
Also, the consumer must be schooled into paying for value received.

Many consumers don't hesitate to pay 100-150% more for such convenience items as "Instant Whip-Cream," yet they are very reluctant to pay any "extra" for tailor-made, waste-free frozen meats.

Much of this reluctance can be overcome by producing and offering for sale at the retail counter, frozen cuts of entirely acceptable quality.

A major objective of the freezing studies conducted at Oklahoma State University was to determine the effects of freezing temperature and storage time on the organoleptic or

Steak 82-R-16 frozen at 15°F. came out dark in color; steak 82-R-9 frozen at 0°F. was lighter; steak 82-R-10 frozen at —40°F. was lighter than the two other steaks and most desirable in color; and the fourth one, frozen at —100°F., was the lightest in color. After thawing, steaks reverted to the normal cherry red. However, the ones frozen at higher temperatures were slightly off-color after thawing.



* A report of work done under contract with the U. S. Department of Agriculture and authorized by the Research and Marketing Act of 1946. The contract is being supervised by the Eastern Utilization Research and Development Division of the Agricultural Research Service.

quality characteristics of beef steaks. It was desired to know the effect of freezing, per se, on tenderness, and the effect of prolonged freezer storage on tenderness.

Experimental material for this study consisted of one-inch thick strip steaks obtained from U. S. Choice, U. S. Good, and U. S. Standard grade beef short loins. All steaks were packaged in aluminum foil.

Freezing temperatures tested included +15°, +10°, 0°, —25°, —50°, —75°, —100°, and —125°F.

Freezer storage periods varied from 0 to 12 weeks.

Trained Panel

The test steaks and unfrozen control samples were evaluated for tenderness, flavor, juiciness and overall satisfaction. Tenderness was evaluated subjectively by means of a trained taste panel. An eight point Hedonic Scale was used for this subjective test.

Tenderness was measured objectively by recording the average pounds force required to shear three one-inch sample cores from each steak with the Warner-Bratzler shear device.

Results showed that freezing influenced steak tenderness. Freezing at +15°F. and +10°F. had an adverse affect on tenderness and overall acceptability of the product, moreover, this detrimental affect becomes more acute as the duration of freezer storage is extended.

On the other hand, steaks frozen at 0°F. and below were slightly more tender than the unfrozen controls, both immediately after freezing and after 12 weeks frozen storage.

In addition, low temperature freezing tended to make the entire steak more uniform in tenderness.

Data also showed that lowering the freezing temperature to —125°F. had no significant effect on increased tenderization. Hence, as far as tenderness is concerned, 0°F. is as effective as —125°F.

Experimental results indicate that juiciness is the only palatability characteristic not favorably affected by freezing.

Taste panel evaluations for flavor, tenderness and overall satisfaction favored the frozen product over the unfrozen control steaks. Thus, if steaks are properly packaged and frozen a very acceptable product can be produced.

Steaks frozen below 0°F. had a moisture content slightly higher than the control samples, but this moisture was apparently lost by evaporation or drip, during cooking, resulting in a lower juiciness score.

Visual observations of the frozen steaks suggested a relationship between steak color and freezing temperature.

Steaks frozen at —100°F. and —125°F. tended to be lighter in color, the color varying from pale to off-red.

On the other hand, samples frozen at the higher temperature, +15°F., were usually quite dark in color.

The most desirable color was found in the steaks frozen at —30 and —40°F.

Little difference was noted in the color of the thawed steaks, with respect to freezing temperature. When thawed, the steaks frozen at the lower temperatures reverted to the normal cherry red color. Samples frozen at +15°F., however, remained a dark dull color when thawed.

With respect to carcass grade, steaks from the Choice grade short loins were found least affected by long term freezer storage. Consequently to insure quality in the frozen product, retail cuts intended for the freezer should be selected from the higher grading carcasses.

Results suggested that steaks should be chilled to approximately 33°F. before being placed in the freezer. This would permit maximum freezer efficiency and result in a more uniformly frozen product.